Claims

1. (Currently Amended) A method for providing power comprising: ~~electrical energy to an electrical device in an environment having a first and a second temperature region comprising the steps of:~~

~~a. providing a means for transmitting ambient energy collected in said first temperature region,~~

~~b. providing a thermoelectric device having a first side and a second side,~~

~~c. providing said means for transmitting said ambient energy collected in said first temperature region in communication with said first side of said thermoelectric device, and~~

~~d. providing said second side of said thermoelectric device in communication with said second temperature region.~~

providing a thermoelectric generator having a first end and a second end;

exposing the first end of the thermoelectric generator to thermal energy of a first temperature region;

exposing the second end of the thermoelectric generator to thermal energy of a second temperature region; and

utilizing a difference between the thermal energy of the first temperature region and the thermal energy of the second temperature region to produce electric power from the thermoelectric generator regardless of whether the first temperature region is warmer or cooler than the second temperature region;

wherein the thermoelectric generator comprises a plurality of thermocouples comprising p-type and n-type thin film semiconductor thermoelements formed on a flexible substrate;

wherein a single p-type thermoelement is, or a plurality of p-type thermoelements in parallel with each other are, electrically connected in series with a single n-type thermoelement or with a plurality of n-type thermoelements in parallel with each other; and

wherein each thermocouple comprises at least three thermoelements.

2 – 4. (Canceled)

5. (Currently Amended) The method of claim [[4]] 1 wherein said p-type thermoelements comprise ~~arrays are selected from the group consisting of~~ antimony telluride, bismuth telluride, lead telluride, tin telluride, zinc antimonide, cerium-iron antimonide, silicon-germanium, ~~and~~ or combinations thereof.

6. (Currently Amended) The method of claim [[4]] 1 wherein said n-type thermoelements comprise ~~arrays are selected from the group consisting of~~ antimony telluride, bismuth telluride, lead telluride, cobalt antimonide; silicon-germanium, ~~and~~ or combinations thereof.

7. (Currently Amended) The method of claim [[2]] 1 wherein the p-type thermoelements comprise ~~said thin film semiconductors are selected as having p-type materials fabricated of~~ antimony telluride, bismuth telluride, lead telluride, tin telluride, zinc antimonide, cerium-iron antimonide, silicon-germanium, ~~and~~ or combinations thereof sputter deposited as thin films on a substrate; and the n-type thermoelements comprise ~~n-type semiconductors fabricated of~~ antimony telluride, bismuth telluride, lead telluride, cobalt antimonide, silicon-germanium ~~and~~ or combinations thereof sputter deposited as thin films on a substrate.

8 – 30. (Canceled)

31. (New) The method of claim 7 wherein each of the p-type thermoelements and the n-type thermoelements are sputter deposited on a single, continuous flexible substrate.

32. (New) The method of claim 31 wherein the single, continuous flexible substrate is wound in a coil configuration.

33. (New) The method of claim 31 wherein the single, continuous flexible substrate is wrapped around a spindle.

34. (New) The method of claim 7 wherein each of the p-type thermoelements and the n-type thermoelements has a length to area ratio of between from about 1,000 cm^{-1} and to about 10,000 cm^{-1}.

35. (New) The method of claim 1 wherein the first temperature region comprises the ground and the second temperature region comprises air above the ground.

36. (New) The method of claim 35 wherein exposing the first end of the thermoelectric generator to a first temperature region comprises attaching a first heat pipe to the first end of the thermoelectric generator and burying the first heat pipe at least partially in the ground.

37. (New) The method of claim 36 wherein exposing the second end of a thermoelectric generator to the thermal energy of the second temperature region comprises attaching a second heat pipe to the second end of the thermoelectric generator wherein the first heat pipe and the second heat pipe have substantially equal heat conduction capacity.

38. (New) The method of claim 1 wherein the first temperature region comprises air inside a building duct and the second temperature region comprises air outside the duct.

39. (New) An electric power generator comprising:

a first thermal energy collector in thermal communication with a first temperature region;

a second thermal energy collector in thermal communication with a second temperature region;

a thermoelectric generator comprising a first side and a second side wherein the first side is in thermal communication with the first thermal energy collector and wherein the second side is in thermal communication with the second thermal energy collector;

the thermoelectric generator further comprising a plurality of thermocouples comprising p-type and n-type thin film thermoelements sputter deposited on a single, continuous flexible substrate;

wherein the first temperature region is at a different temperature than the second temperature region;

wherein the thermoelectric generator utilizes the temperature difference between the first temperature region and the second temperature region to produce electric power regardless of whether the first temperature region is warmer or cooler than the second temperature region;

wherein the first thermal energy collector is a first heat pipe; and

wherein the second thermal energy collector is a second heat pipe positioned on an opposite side of the thermoelectric generator from the first heat pipe, and the first heat pipe and the second heat pipe have substantially equal heat conduction capacity.

40. (New) The electric power generator of claim 39 wherein the temperature difference between the first temperature region and the second temperature region is from about 0.5 ° to about 100 ° F.

41. (New) The electric power generator of claim 39 wherein the temperature difference between the first temperature region and the second temperature region is from about 0.5 ° to about 50 ° F.

42. (New) The electric power generator of claim 39 wherein each thermocouple comprises a single p-type thermoelement or a plurality of p-type thermoelements in parallel with each other and electrically connected in series with a single n-type thermoelement or with a plurality of n-type thermoelements in parallel with each other; and

wherein each thermocouple comprises at least three thermoelements.

43. (New) The electric power generator of claim 39 wherein each of the p-type and n-type thermoelements has a length to area ratio of between from about 1,000 cm^{-1} and to about 10,000 cm^{-1}.

44. (New) The electric power generator of claim 39 wherein the first temperature region comprises the ground and the second temperature region comprises the air above the ground.

45. (New) The electric power generator of claim 39 wherein the first temperature region comprises air inside a building duct and the second temperature region comprises air outside the duct.

46. (New) The electric power generator of claim 39 wherein the single, continuous flexible substrate is spirally wound.

47. (New) The electric power generator of claim 39 wherein the single, continuous flexible substrate is wrapped around a generally cylindrical structure.

48. (New) The electric power generator of claim 39 wherein at least one of the thermocouples further comprises a p-type or an n-type metallic thermoelement.

49. (New) A thermoelectric power generator comprising:

a thermoelectric generator comprising a first side and a second side wherein the first side is in thermal communication with a first temperature region and the second side is in thermal communication with a second temperature region;

wherein the thermoelectric generator utilizes a temperature difference between the first temperature region and the second temperature region to produce electric power regardless of whether the first temperature region is warmer or cooler than the second temperature region;

wherein the thermoelectric generator comprises a plurality of thermocouples comprising p-type and n-type thin film thermoelements sputter deposited on a single, continuous flexible substrate;

wherein the p-type thermoelements comprise antimony telluride, bismuth telluride, lead telluride, tin telluride, zinc antimonide, cerium-iron antimonide, silicon-germanium, or combinations thereof;

wherein the n-type thermoelements comprise antimony telluride, bismuth telluride, lead telluride, cobalt antimonide; silicon-germanium, or combinations thereof; and

wherein the single, continuous flexible substrate is wound in a coil configuration.

50. (New) The thermoelectric power generator of claim 49 further comprising:

a sensor in electrical communication with and powered by a thermoelectric generator;

wherein each thermocouple comprises a single p-type thermoelement or a plurality of p-type thermoelements in parallel with each other and electrically connected in series with a single n-type thermoelement or with a plurality of n-type thermoelements in parallel with each other;

wherein each thermocouple comprises at least three thermoelements;

wherein each element of the p-type thermoelements and the n-type thermoelements has a length to area ratio of from about 1,000 cm^{-1} to about 10,000 cm^{-1}.